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WHAT IS THE USE OF WATER?

Why is it that of the whole surface of this globe, we may consider that three-fourths are covered by water, and that only one-fourth is in a condition to be permanently inhabited by human beings? Is there any great object in nature served by this? Is there any law of nature which would prevent the proportion being one-fourth water to three-fourths land, or even less water? In fact, what after all is the great use of water upon the large scale in nature?

First of all, although three-fourths of the globe are now covered with water, there is no reason to suppose that it has been always so. On the contrary, it is quite certain that the proportion between land and water has changed very much and very frequently; that the whole continent of Europe was at one time the bed of an immense sea, when probably there was a great continent where the Pacific Ocean is now spread; that even Old Ireland was once not merely what Admiral Yorke wished her to be, forty-eight hours under water, but probably many thousand years in that condition; and that the great tract of limestone which occupies all the centre of the country, is nothing more than a collection of the skeletons of shell-fish, her first inhabitants, which by time and pressure have been converted into the hard material of which we build our houses, and which we burn into lime. There is thus no particular reason why there should be three times as much water at present as land, but it is easy to show that water on the great, as well as on the small scale, is of paramount importance in nature.

Water is a portion of the food of all living beings. In the case of animals, the bodies from whence they derive nutriment are so varied and so complex, that to illustrate the peculiar part which water plays in each, would occupy too much space. In all our drinks, even in ardent spirits, there is a very large quantity of water, and our solid food very seldom contains less than nine-tenths of its weight of water. The living body is even less solid. A man weighing 150 lbs. would, if perfectly dried, weigh not more than 10 lbs., the other 140 lbs. being water. It is to the existence of this quantity of water that we owe the elasticity, the softness, and pliability of the different portions of our frame, the animal tissues being, when dry, hard and brittle as dry glue.

The nutrition of vegetables furnishes a beautiful and simple example of the use of water in nature. The body of the vegetable, the proper wood, may be considered as being composed of water and of charcoal; and hence, when we heat a piece of wood until we decompose it, the water is expelled, and carbon or charcoal remains behind. In order to grow, a plant must therefore get water and charcoal in a form fit for its use, that is, in such a form as it can make food of, and digest them. For this, the carbon is supplied in the carbonic acid which the air contains, and the water in the state of vapour which the air contains also, and which is continually descending under the form of dew and rain to moisten the leaves and the roots of the plants, when it has been absorbed into the ground. All the water which is absorbed by plants is not assimilated, or digested; a great part is again thrown out by the surface of the leaves; for, precisely as the air which an animal expires from the lungs in breathing is loaded with vapour, so is there a process of perspiration from the surface of the leaves, which are the lungs of plants. For the formation of substances which are peculiar to certain plants, other substances are required as food. Thus, most plants require nitrogen, which is accordingly furnished abundantly in atmospheric air; others must have access to sulphur, in order to flourish; but this depends, as it were, upon particular branches of manufacture in which the plant is engaged; for its own support, for making wood, and the tissue of its leaves and vessels, it uses only water and carbonic acid.

The conversion of water into steam or invisible vapour by boiling, is one of the best known facts in science; but by a little attention we can observe that this change takes place at almost all temperatures, although much less rapidly. Thus, if a little water be laid in a plate, it is soon dried up, and wet clothes, by being hung up in the air, are very soon completely dried. Even below the temperature at which water freezes, it still evaporates; and thus, when a fall of snow is succeeded by a continued frost, the snow gradually disappears from the fields without having melted, evaporating while yet solid. From the surface of all the water of the globe, therefore, there is continually ascending a stream of watery vapour; but as the proportion of sea is so much greater than that of land, we may

look upon the ocean as being the source of the watery vapour of the air upon the large scale.

Now, watery vapour is lighter than air, and hence the vapour, as soon as formed, ascends in the air like a balloon, until it arrives at a part of the air which is of its own specific gravity. The air in these higher regions is extremely cold, and the vapour can no longer maintain itself under the form of invisible steam: it is condensed, and would immediately fall back to its source as rain or hail, but for a singular property which it acquires at the moment of being vaporized. When water evaporates, it becomes highly electrified, and could attract a feather, or other light bodies, like a stick of sealing-wax which has been rubbed briskly on a woollen cloth. Now, the vapour which passes off is electrified also; and while in this state of electricity, it, on arriving at the colder regions of the air, cannot condense, to form liquid water. The minute particles of the water repel each other too violently, in virtue of their electricities, to form drops, but they constitute the great loose collections of clouds which diversify so much the appearance of our sky. The clouds being thus highly electrical, and being very light, are attracted by the tops of mountains and high lands, or by elevated buildings; and, giving off their electricity, the particles of water coalesce, to form drops which descend as rain. In this country the air is so damp that in general the discharge of the electricity of the clouds takes place quietly and silently; but in summer, and in dry climates, it produces the vivid flashings and injurious effects of the lightning, and the re-echoed rattle of the thunder-clap.

When water is cooled, it diminishes in bulk like other bodies; but at a particular temperature it deviates from the general law of contraction, and by doing so, becomes, perhaps, the most striking example of providential design that is to be met with in inorganic nature. Cold water is specifically heavier than warm water, in consequence of the contraction it has undergone, and hence will sink in it, as water would sink in oil. Now, if we consider the surface of a lake exposed to the cooling action of a wintry wind, the water which is first cooled becomes heavier, and, sinking to the bottom, is replaced by the warmer water, which floats up to the top; there is thus a current established of cold water descending and of warmer water rising up. This continues until all the water in the lake has been cooled down to the temperature at which its specific gravity is greatest, which is about 40 degrees, or about eight degrees above the point at which it begins to freeze. The action of the cold wind continuing, the water at the surface is still further cooled; but now, in place of contracting, it expands—instead of becoming heavier, it becomes lighter, and remains floating upon the surface. It is then still further cooled, and finally its temperature being reduced to 32 degrees, it freezes, and a layer of ice is formed on the surface of the lake. This ice, and the cold water next it, are impermeable to heat: it actually serves as a blanket to the water at 40 degrees which is below, preventing the escape of the heat, and retaining it at that temperature, sufficient for the purposes to which it is subservient; for at the temperature of 40 degrees, the life and enjoyments of all the various tribes of animals and vegetables which reside permanently under the surface of the water are perfectly secured, at least for a very considerable time; the water holding dissolved a quantity of oxygen for the animal respiration, and the vegetables living on the carbonic acid which is formed by the respiration of the fish. On the approach of spring, the warmer air, and the rays of the more elevated sun, act directly on the surface of the ice, and each portion of water formed by melting, becoming heavier, sinks, so as to expose the ice itself to the source of heat. Thus the ice is rapidly dissolved, and after a few days the lake throws off its wintry aspect altogether.

Now, if water did not possess this peculiarity of being heaviest at the particular temperature of 40 degrees—if it contracted according as it was cooled, up to the moment of freezing, as almost all other liquids do, what would be the result? The cold wind acting on the surface of the lake, and the water becoming heavier by being cooled, the circulation would continue until all the water had been cooled to the point at which it freezes. The ice would then form indifferently in all portions of it, at the bottom and in the centre, as well as on the surface; and by the continued action of the source of cold, the wind, the whole mass of water in the lake would be frozen into a solid block of ice. The watery sap in the vessels of the aquatic plants, the blood in fishes and other animals inhabiting the water, would be equally frozen, and all these living beings consequently killed. Further, on the approach of sum-

mer, by the first heating action of the air and sun, a layer of ice, of a few inches thick upon the surface, would be melted, but the water thus produced would, by being impenetrable to heat, prevent the great body of ice below from being affected. Just as, in reality, the cold water at the surface prevents the warmer water below from being cooled, so then it would prevent the colder ice below from being warmed; and hence the heats of summer passing over without the melting process extending beyond a few feet in depth, the first cold days of the next winter would solidify all again.

In every country, therefore, where at present water is frozen at all in winter, we should have there established the reign of perpetual frost. By the presence of such large masses of ice, the temperature of the ground would be so much reduced, that, in place of the rich herbage of our meadows, and the luxuriant produce of our corn-fields, we should have our country yielding a scanty support to wandering herds of deer, in the mosses and lichens that could be scraped up from beneath the snow. The oaks, the beeches, the horse-chestnuts, which give such beauty to our sylvan scenery, would disappear, and the monotony of wildernesses of the Scotch fir and of the spruce would be varied only by patches of stunted birch. The countries nearer the tropics would be gradually brought into the same condition, by the depression of their mean temperature; and thus, in a short time after water had ceased to possess this peculiar property, the whole surface of the globe would be reduced to the condition of which we now happily only read in the tales of the arctic voyagers; and all commerce, manufactures, and civilization, would be banished from the earth. Of such value is this little peculiarity of water!

A property of water, which, however, unlike the former, it shares with all other liquids, is, that when it freezes it gives out a large quantity of heat; and that conversely, in order that ice may melt, it must obtain, from some other source, a quantity equally considerable. Consequently, water freezes and ice melts very slowly; and that it should melt thus slowly, is of essential importance in animated nature. If in spring or summer, when vegetable life is in activity, when the development of leaves, of flowers, and fruit, is at its greatest energy, and all the vessels of the plant are distended with its nutritious juices, were it suddenly exposed to cold, the sap would be frozen, and by the expansion of the ice the vegetable tissues torn to pieces, and the plant killed. In the thin extremities, as in the leaves, such is the effect of the frost of a single night; but as the fluids, yielding but gradually up their latent heat, solidify very slowly, the injury does not extend so far as to be beyond the remedial powers of the plant itself. In another way, however, the peculiar latent heat of water is of still more importance. If there was no large collection of water on the globe, the change of seasons would be amazingly more rapid and more remarkable than they at present are. A change in the direction of the wind, the alteration which a few weeks should effect in the position of the sun, would transfer us from the depth of the severest colds of winter to the summer heats. These colds and heats would also be much greater than they at present are, and an approximation to this actually occurs in countries far distant from the sea. The central districts of Europe and of Asia have what are termed continental climates to distinguish them from ours, which is called insular. Their summers are hotter, their winters are much colder, and the spring and autumn seasons of passage, which with us might be said to occupy most of the year, are in those countries of only a few weeks', or even a few days', duration. In fact, when on the cessation of summer the first cold winds tend to bring on the winter, and to bind up our lakes in frost, the first portion of water frozen becomes, by giving up its latent heat, a source of warmth which tempers the chilly air, and retards its action on the remainder. The water freezes thus very slowly. The vegetables, and certain classes of animals, feeling the cold of winter thus gradually coming on, prepare to meet it without injury. The motion of the sap in the one, that of the blood in the other class of living beings, becomes slower, and, dropping its leaves and fruit, the tree retains but its firm trunk, within which its energies are preserved for the ensuing season; whilst the hedgehog, the viper, the frog, and other animals, retire to their hiding-places, and in a state of almost lifeless stupor remain until the warmth of the succeeding spring calls them to renewed existence.

In the formation of the insular climate which we possess, another power of water, however, equally or perhaps more influential, can be traced. There issues continually from the ocean at the equator, as the earth revolves, a current of water

considerably warmer than that which bathes our shores. This current becoming sensible first in the Gulf of Mexico, is called the Gulf Stream; it passes obliquely across the Atlantic, floating on the colder water of the ocean, which tends in a direction nearly opposite to replace it, and thus diffuses over the coasts of North America and Europe the heat which it had absorbed within the torrid zone. The northerly winds, which would bring down a sudden winter on us, are therefore tempered by passing over the warmer surface of the ocean; whilst the hot winds from the south, which on the approach of spring might make too premature a change, expend, in passing over the great expanse of sea, a portion of their heat; and thus the transition in both directions is rendered more gradual and harmless.

These are but a few of the important duties which are allotted to water in its place in nature. It in other respects presents an equally interesting subject of examination, and it is one to which we shall return. From its value as the great agent of nutrition to the vegetable world, and the necessity of a supply of it to animals; from its power in modifying the appearance and structure of a country, changing land into sea, and elevating banks where deep water had been before, the philosophers of old looked upon water as the origin of all earthly things, as being above all others the element of nature. It is not so: water is not an element. Among other wonders which chemistry has taught us, we have learned of what water is composed; and on another occasion we shall describe the way in which its elements may be obtained. K.

CELEBRATION OF THE FOURTH OF JULY IN NEW YORK.—On this day, the anniversary of American independence, all creation appeared to be independent; some of the horses particularly so, for they would not troop "in no line not nobow." Some preferred going sideways, like crabs; others went backwards, some would not go at all, others went a great deal too fast, and not a few parted company with their riders, whom they kicked off just to show their independence. And the women were in the same predicament: they might dance right or dance left; it was only out of the frying-pan into the fire, for it was pop, pop; bang, bang; fiz, pop, bang; so that you literally trod upon gunpowder. The troops did not march in very good order, because, independently of their not knowing how, there was a good deal of independence to contend with. At one time an omnibus and four would drive in and cut off the general and his staff from his division; at another, a cart would roll in and insist upon following close upon the band of music; so that it was a mixed procession—generals, omnibuses and four, music, cart-loads of bricks, troops, omnibuses and pair, artillery, hackney-coach, &c. "Roast pig" is the favourite "independent" dish, and in New York on the above day are "six miles of roast pig," viz. three miles of booths on each side of Broadway, and roast pig in each booth! Rockets are fired in the streets, some running horizontally up the pavement, and sticking into the back of a passenger; and others mounting slanting-dicularly, and Paul-Prying into the bedroom windows on the third floor or attics, just to see how things are going on there. On this day, too, all America gets tipsy.—*Captain Marryatt's Diary in America.*

IRISH DRAMATIC TALENT.—Difference of taste makes it difficult, if not impossible, to say which is the best comedy in the English language. Many, however, are of opinion that there are three which more particularly dispute the palm—namely, "She Stoops to Conquer," "The School for Scandal," and "The Heiress;" and it is remarkable that the authors of these three beautiful productions were all Irishmen—Goldsmith, Sheridan, and Murphy.—*Literary World.*

THE MORNING.—The sweetness of the morning is perhaps its least charm. It is the renewed vigour it implants in all around that affects us—man, animals, birds, plants, vegetation, flowers. Refreshed and soothed with sleep, man opens his heart; he is alive to Nature, and Nature's God, and his mind is more intelligent, because more fresh. He seems to drink of the dew like the flowers, and feels the same reviving effect.—*Illustrations of Human Life.*

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